

INTRODUCTION TO HYDROGEN PEROXIDE

physical and chemical properties of hydrogen peroxide

Contents:

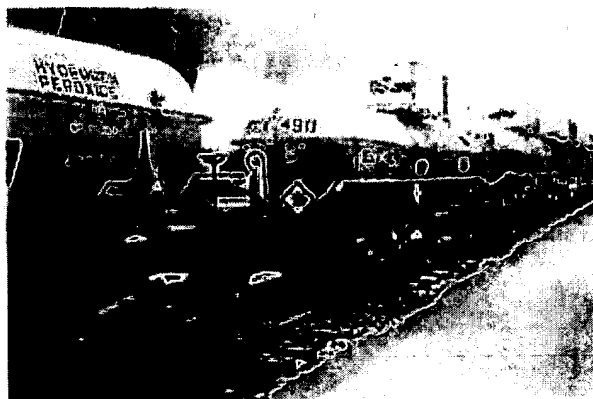
► Summary

► Physical Properties

1. Equivalent values of concentration
2. Density of H₂O₂ solutions
3. Density of H₂O₂ vapors
4. Coefficient of cubical expansion
5. Partial molal volumes
6. Viscosity of H₂O₂ solutions
7. Viscosity of H₂O₂ vapors
8. Surface tension of H₂O₂ solutions
9. Coefficient of diffusion
10. Boiling points and freezing points
11. Solid-liquid phase diagram
12. Heat of fusion
13. Vapor Pressures
14. Equilibrium vapor-liquid concentrations
15. Activity coefficients
16. Heat of vaporization
17. Thermal conductivity of liquid
18. Thermal conductivity of vapor
19. Heat capacity of liquid
20. Heat capacity of vapor

► Thermodynamic Properties

1. Molecular data
2. Thermodynamic functions
3. Heat capacity
4. Heats of dilution
5. Heat of decomposition
6. Decomposition: Heat, Free Energy, and Equilibrium Constant
7. Decomposition products
8. Decomposition volumes
9. Self-accelerated decomposition
10. Free energy of formation
11. Standard electrode potentials
12. pH and Ionization Constant
13. Dissociation: Heat, Free Energy, and Equilibrium Constant
14. Related Electrochemical Values



Exh. 6. + A

► **Electrical Properties**

1. [Conductivity](#)
2. [Dielectric constant](#)
3. [Magnetic susceptibility](#)

► **Radiation Properties**

1. [Refractive index](#)
2. [Magneto-optic rotation](#)
3. [Microwave absorption spectrum](#)
4. [Infrared absorption spectrum](#)
5. [Raman spectrum](#)
6. [Visible spectrum](#)
7. [Ultraviolet absorption spectrum](#)

► **Solubility Properties**

Solubility / Distribution coefficients in selected solvents

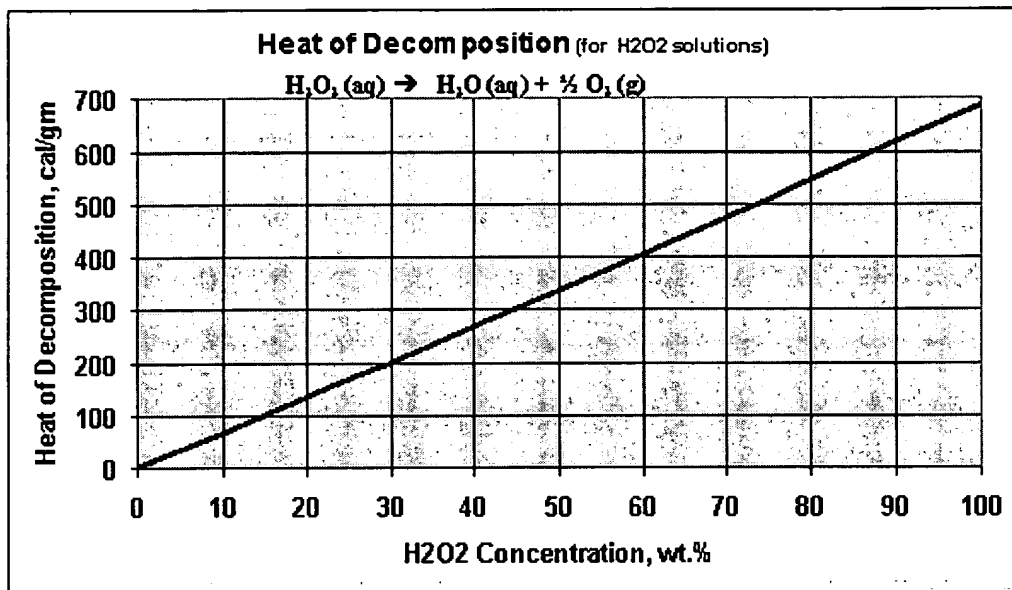
1. Alkanes
2. Aromatics
3. Ethers
4. Alcohols
5. Other

[**\[To Frequently Asked Questions \(FAQ\)\]**](#)

Home	Email Us!	Join Our Mailing List!	Search	What's New	Links
----------------------	---------------------------	--	------------------------	----------------------------	-----------------------

Copyright © H2O2.com

5. Heat of decomposition

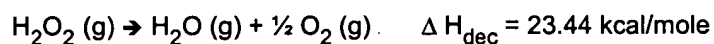


P.A. Giguere, *Complements au Nouveau Traite de Chemie Minerale – No. 4 Peroxyde d'Hydrogene et Polyoxydes d'Hydrogene*, Paris, Mason, p.181 (1975)

NOTES:

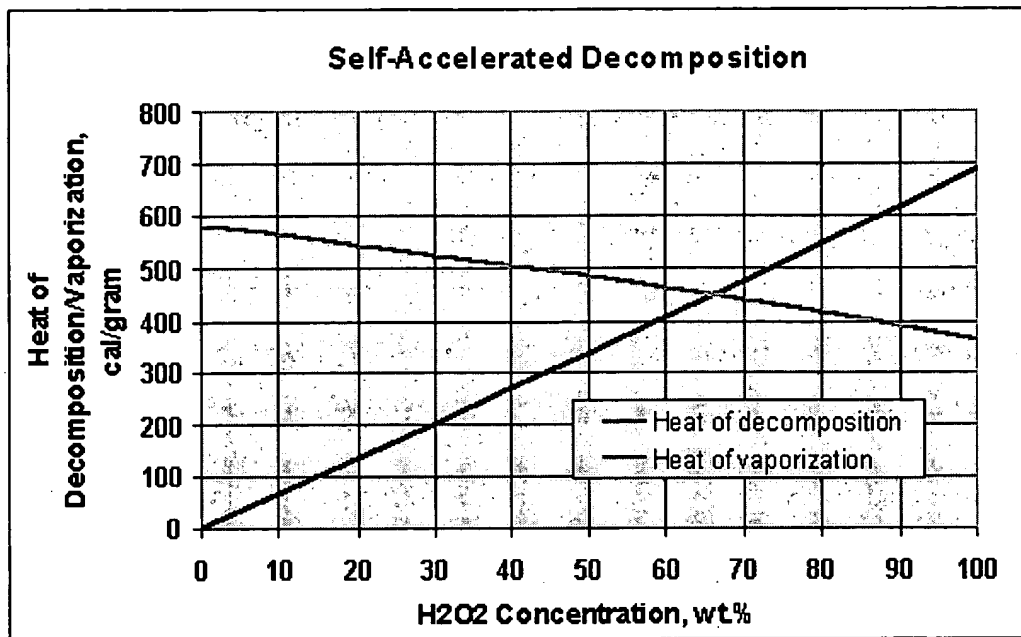
1. The standard free energy change (ΔF°) is -27.92 kcal/mole at 25 °C
2. Rapid decomposition of concentrated H₂O₂ solutions may not be complete, with concentrations up to 10% remaining.

6. Heat, Free Energy, and Equilibrium Constant



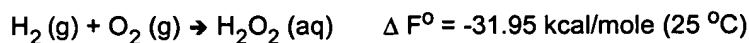
W.C. Schumb, C.N. Satterfield, R.L. Wentworth. *Hydrogen Peroxide*, ACS Monograph, Reinhold Publishing, pg. 251 (1955).

7. Decomposition products



- NOTES:**
1. H₂O₂ decomposition is highly exothermic (23.44 kcal/mole). Even 10% H₂O₂ can boil if it becomes grossly contaminated.
 2. The effect of temperature is such that an increase of 10 °C increases the rate of decomposition by a factor of 2.3 (i.e., a first order rate equation). Therefore, decomposition can accelerate if the solution becomes grossly contaminated.
 3. As the concentration of H₂O₂ in solution increases, there is less water to absorb the heat of decomposition. A crossover occurs at 63-64% H₂O₂ where rapid, accelerated decomposition becomes self-sustaining and the concentration of H₂O₂ in the decomposing solution can actually increase.

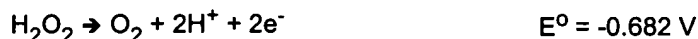
10. Free energy of formation



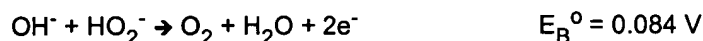
Temp., °K	ΔH, kcal/mole	ΔF, kcal/mole	log K
0	-31.26	-31.26	---
298	-32.52	-25.24	18.51
300	-32.54	-25.20	18.35
400	-32.80	-22.71	12.41
500	-33.01	-20.16	8.81
600	-33.15	-17.58	6.40
700	-33.30	-14.98	4.68
800	-33.38	-12.36	3.38
900	-33.48	-9.73	2.36
1000	-33.56	-7.08	1.55
1100	-33.63	-4.43	0.88
1200	-33.69	-1.83	0.33
1300	-33.73	0.92	-0.15
1400	-33.77	3.56	-0.56
1500	-33.79	6.24	-0.91

11. Standard electrode potentials

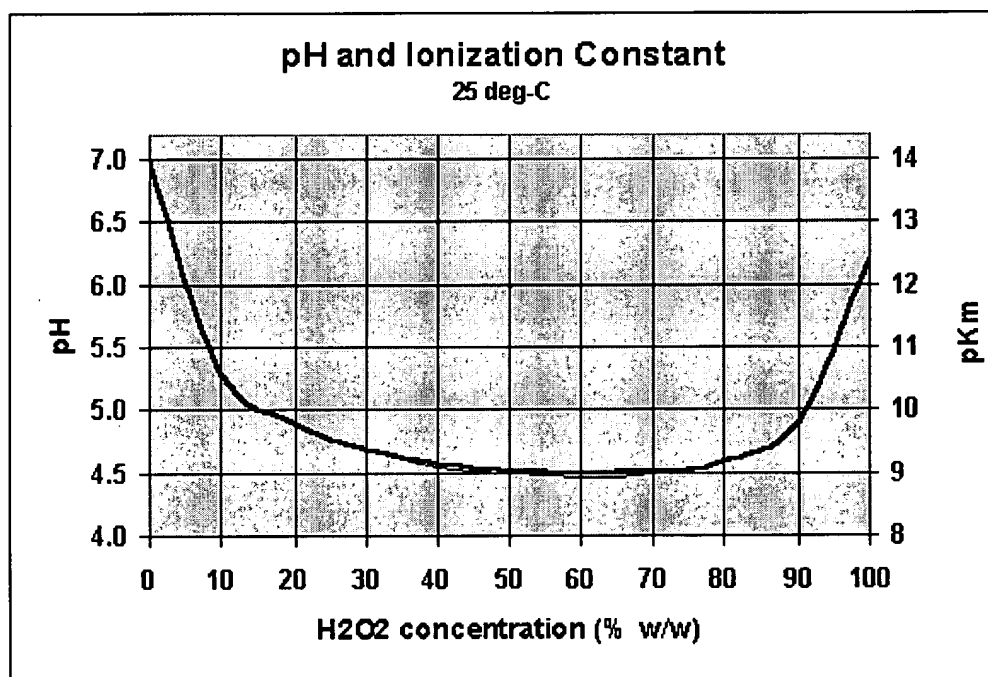
H_2O_2 contains oxygen in a state of oxidation midway between molecular oxygen and water.



For perhydroxyl ion (HO_2^-):



12. pH and Ionization Constant



13. Dissociation: Heat, Free Energy, and Equilibrium Constant

	ΔH°	ΔF° (kcal/mole)
<u>Nonionic</u>		
$\text{H}_2\text{O}_2(\text{g}) = \text{H}_2\text{O}(\text{g}) + \text{O}(\text{g})$	+ 33.90	+ 25.60
	+ 136.72	+ 122.41